

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
LABORATORY TEST PROCEDURE
FOR
FMVSS No. 214 “DYNAMIC”
SIDE IMPACT PROTECTION



ENFORCEMENT
Office of Vehicle Safety Compliance
Room 6111, NVS-220
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Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 214D
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REVISION CONTROL LOG**FOR OVSC LABORATORY
TEST PROCEDURES****TP214 "DYNAMIC"
SIDE IMPACT PROTECTION**

TEST PROCEDURE		FMVSS 214D		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00				
01	8/9/91			Draft Test Procedure
02	5/26/92	56 FR 40937		Addition of comments on Draft Test Procedure.
03	5/17/93		9/1/93	Minor revisions
04	9/1/95		9/1/95	Metric Conversion
05	8/2/99	60 FR 38761	8/2/99	Updated for upgrade to LTV's
06	7/26/01		7/26/01	Minor revisions. Changes concerning ensuring doors are closed prior to test.
07				Minor revisions
08				

1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contractor laboratories with Laboratory Test Procedures as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. If any contractor views any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard (FMVSS) or observes deficiencies in a Laboratory Test Procedure, the contractor is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Every contractor is required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used. The contractor's test procedure shall contain a complete listing of test equipment with make and model number and a detailed check-off sheet. The list of test equipment shall include instrument accuracy and calibration dates. All equipment shall be calibrated in accordance with the manufacturer's instructions. There shall be no contradictions between the Laboratory Test Procedure and the contractor's in-house test procedure. Written approval of the in-house test procedures shall be obtained from the COTR before initiating the compliance test program. The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data. These Laboratory Test Procedures do not constitute an endorsement or recommendation for use of any product or method. However, the application of any such testing technique or equipment is subject to prior approval of the COTR.

NOTE: The OVSC Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct compliance tests for the OVSC, are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS. The Laboratory Test Procedures are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Recognizing applicable test tolerances, the Laboratory Test Procedures may specify test conditions that are less severe than the minimum requirements of the standard. In addition, the Laboratory Test Procedures may be modified by the OVSC at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests are performed in a manner consistent with the standard itself and within the scope of the contract. Laboratory Test Procedures may not be relied upon to create any right or benefit in any person. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits its certification tests to those described in the OVSC Laboratory Test Procedures.

2. GENERAL REQUIREMENTS

FMVSS 214, Side Impact Protection, specifies performance requirements for protection of occupants in side impact crashes.

The purpose of this standard is to reduce the risk of serious and fatal injury to occupants of motor vehicles in side impact crashes by specifying vehicle crashworthiness requirements in terms of accelerations measured on anthropomorphic dummies in test crashes, and by specifying strength requirements for side doors. This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks and buses with a GVWR of 2,721.6 kg (6,000 lbs) or less except for walk-in vans, motor homes, tow trucks, dump trucks, ambulances and other emergency rescue/medical vehicles (including vehicles with fire-fighting equipment), vehicles equipped with wheelchair lifts, and vehicles which have no doors or exclusively have doors that are designed to be easily attached or removed so the vehicle can be operated without doors.

When tested according to the test conditions outlined in this test procedure, each multipurpose passenger vehicle, truck and bus manufactured on or after September 1, 1996, shall meet the requirements of S5.1, S5.2 and S5.3 in a 53.9 kph (33.5 mph) impact in which the vehicle is struck on either side by a moving deformable barrier. A Regulation Part 572, Subpart F test dummy is placed in the front outboard seating position on the struck side of the vehicle, and if the vehicle is equipped with rear seats, then another part 572, Subpart F test dummy is placed on the outboard seating position of the second seat on the struck side of the vehicle. However, the second seat requirements do not apply to side-facing seats or to vehicles that have second seating areas that are so small that the Part 572, Subpart F dummy can not be accommodated according to the positioning procedure specified in this test procedure.

NOTE: The rear seat requirements do not apply to passenger cars with a wheelbase greater than 3,302 millimeters or to third row seats.

S5.1 The Thoracic Trauma Index (TTI(d)) shall not exceed:

- (a) 85 g's for a passenger car with four side doors, and for any multipurpose passenger vehicle, truck, or bus; and,
- (b) 90 g's for a passenger car with two side doors, when calculated in accordance with the following formula:

$$TTI(d) = \frac{1}{2} (G_r + G_{LS})$$

G_r - Is the greater of the peak accelerations of either the upper or lower rib

G_{LS} - Is the lower spine peak acceleration

S5.2 The peak lateral acceleration of the pelvis shall not exceed 130 g's

2. GENERAL REQUIREMENTSContinued

S5.3 Door Opening

S5.3.1 Any side door, which is struck by the moving deformable barrier shall not separate totally from the car.

S5.3.2 Any door (including a rear hatchback or tailgate), which is not struck by the moving deformable barrier, shall meet the following requirements:

S5.3.2.1 The door shall not disengage from the latched position:

S5.3.2.2 The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle.

S5.3.2.3 Neither the latch nor the hinge systems of the door shall pull out of their anchorages

3. SECURITY

The Contractor shall provide appropriate security measures to protect the OVSC test vehicles and other Government Furnished Property (GFP) from unauthorized personnel during the entire compliance-testing program. The Contractor is financially responsible for any acts of theft and/or vandalism, which occur during the storage of test vehicles and GFP. Any security problems, which arise, shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

The Contractor shall protect and segregate the data that evolves from compliance testing before and after each vehicle test. No information concerning the vehicle safety compliance testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Branch or Division Chief.

NOTE: NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE COMPLIANCE TESTING PROGRAM, SHALL BE ALLOWED TO WITNESS ANY VEHICLE COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle compliance testing area, dummy calibration laboratory, test fixtures and instrumentation in a neat, clean and painted condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The Contractor shall submit a test schedule to the COTR prior to testing. Tests shall be completed as required in the contract. Scheduling shall be adjusted to permit sample motor vehicles to be tested to other FMVSS as may be required by the OVSC. All testing shall be coordinated to allow monitoring by the COTR.

6. FACILITY AND EQUIPMENT – PRETEST REQUIREMENTS

6.1 TEST PAD AREA:

The test pad area shall be a level, smooth and uniformly constructed concrete surface that is large enough such that all four wheels of the test vehicle and all four wheels of the MDB remain in the same plane throughout the impact event.

6.2 TOW ROAD:

The tow road surface shall be a straight, level, smooth and uniformly constructed surface that is long enough to allow the MDB velocity to stabilize prior to impacting the test vehicle.

6.3 TEST VEHICLE PREPARATION BUILDING/STRUCTURE:

The test vehicle preparation building/structure encloses the area where the test vehicle is prepped during pre-test set-up that occurs just prior to the impact test. This building or structure shall be temperature-controlled and large enough to house the test vehicle, test equipment and instrumentation while allowing room for personnel to move freely about the test vehicle. The temperature inside of the test vehicle must be maintained between 18.9EC and 25.5EC for a minimum of four (4) hours prior to the side impact event. For facilities that require testing outdoors, the preparation structure must be capable of being removed quickly prior to conducting the test.

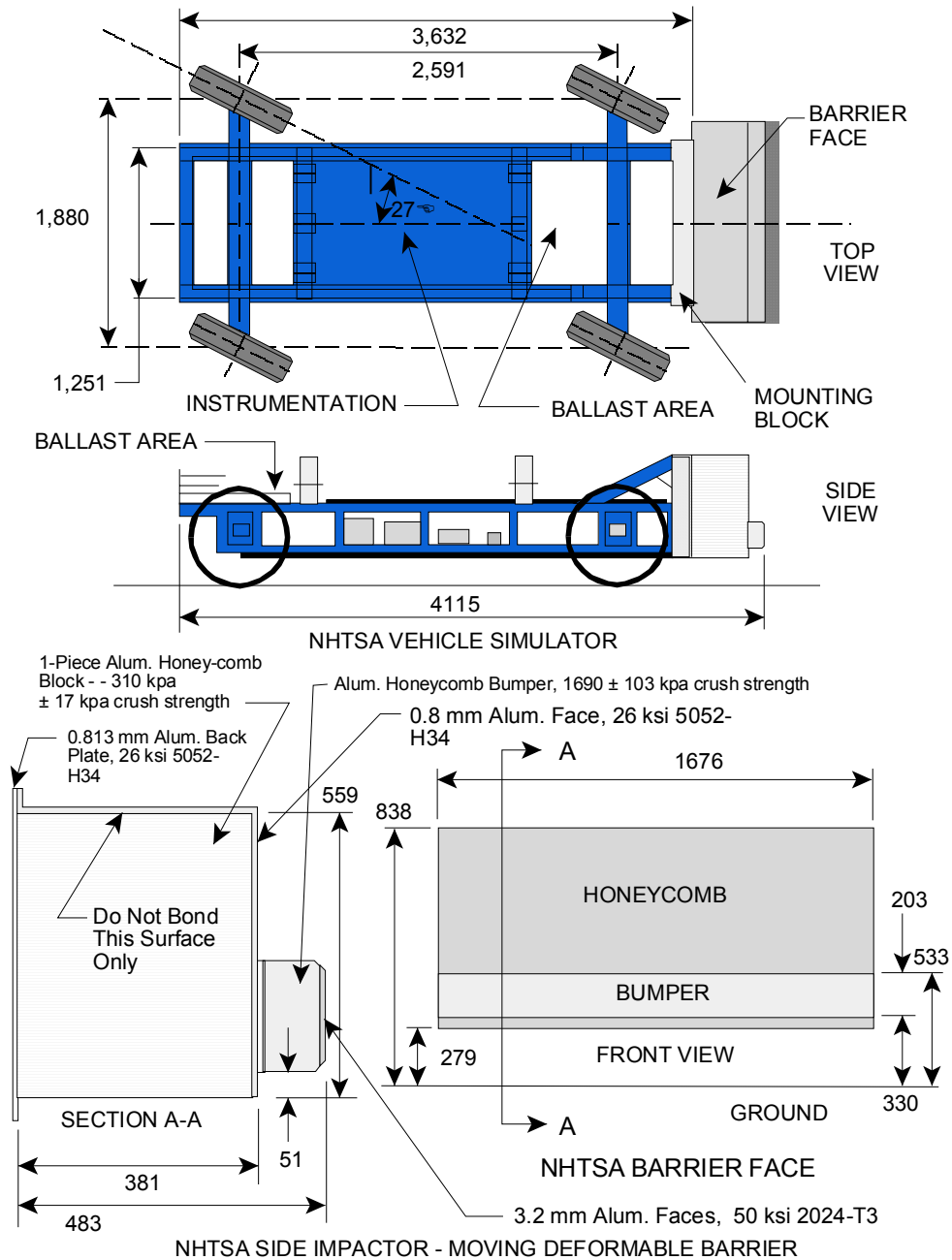
6.4 MOVING DEFORMABLE BARRIER (MDB):

The contractor shall provide a moving deformable barrier (see Figure 1) as specified in FMVSS 214. A summary of MDB and honeycomb face details are provided as follows:

- A. Total weight of MDB with impact face (for compliance purposes) shall be $1,361 \pm 4.5$ kg [1,356.5 - 1,365.5] (configured MDB weight of 1,367.6 kg stated in P587.6(c)).
- B. Overall length of MDB with impact face = $4,115$ mm \pm 25 mm

6. FACILITY AND EQUIPMENT – PRETEST REQUIREMENTS....Continued

Figure 1 – MDB and Honeycomb Face



- C. Overall length of MDB excluding impact face = 3,632 mm (includes 50.8 mm thick mounting block)
- D. Overall width of framework carriage = 1,251 mm
- E. Tracking width (centerline to centerline of front or rear wheels) = 1,880 mm

6. FACILITY AND EQUIPMENT – PRETEST REQUIREMENTS....Continued

- F. Wheelbase for framework carriage = 2,591 mm \pm 25 mm
- G. Inertial properties of the MDB with two cameras and camera mounts and a light trap vane and ballast reduced, the center of gravity (CG) is as follows:

X = (1,123 \pm 25) mm rear of front axle
 Y = (7.6 \pm 25) mm left of longitudinal centerline
 Z = (500 \pm 25) mm from ground

Moments of inertia (tolerance \pm 5% for testing purposes) are as follows:

Pitch = 2,263 kg-m²
 Roll = 508 kg-m²
 Yaw = 2,572 kg-m²

- H. Shape of honeycomb impact face
 - Width = 1,676 mm \pm 6 mm
 - Height = 559 mm \pm 6 mm
 - Ground Clearance = 279 mm \pm 3 mm
 - Depth at Bumper Height = 483 mm \pm 6 mm
 - Depth at upper impact face = 381 mm \pm 6 mm
- I. Force-deflection properties (crush strength) for honeycomb impact face shall be 310 kpa \pm 17 kpa and 1,690 kpa \pm 103 kpa for the bumper.
- J. Position of four wheels on framework carriage = 27E \pm 1E

All Measurements in millimeters (mm)

6.5 TOW AND GUIDANCE SYSTEM:

The tow system must be capable of ensuring that the Moving Deformable Barrier (MDB) impact the test vehicle at a speed of **52.9 kph \pm 0.8 kph**. The MDB is continuously towed until 305 mm from impact (tolerance window of 610 mm to 152 mm). The tow attachment device must release within the tolerance window. The MDB velocity measurement will be taken after release.

The lateral guidance system ensures that the MDB impact the side of the test vehicle at the designated point and angle within the specified tolerances.

6. FACILITY AND EQUIPMENT – PRETEST REQUIREMENTS....Continued

6.6 MOVING DEFORMABLE BARRIER (MDB) VELOCITY MEASUREMENT:

The MDB final impact velocity is measured after the tow system releases. Final impact velocity is measured by no less than two sets of timing devices accurate to within ± 0.08 kph and calibrated by an instrument traceable to the National Institute of Standards and Technology (NIST). The reported final impact velocity shall take into consideration all of the response characteristics of the entire velocity measurement system utilized in its determination.

6.7 MOVING DEFORMABLE BARRIER (MDB) BRAKE ABORT SYSTEM:

The MDB is equipped with an onboard brake abort system that when triggered is capable of stopping the MDB before it impacts the test vehicle. Abort criteria consists of MDB velocity, data acquisition and instrumentation system readiness, and stability of the MDB on the tow road. The first two criteria are to be automatically monitored by the test control system while the third is manually monitored by the test director.

6.8 ALUMINUM HONEYCOMB BARRIER FACE UNITS:

The Contractor is responsible for procuring aluminum honeycomb barrier face units from honeycomb barrier manufacturers. The Contractor shall conduct a detailed inspection of each honeycomb barrier shipment upon arrival and record any damage. The Contractor shall retain a copy of the manufacturer's test data used to certify the barrier face and make it available for review by the COTR. This shall consist of certification information for the 310 kpa and 1690 kpa barrier face portions. The Contractor is responsible for verifying the manufacturer's certification data by conducting tests on honeycomb samples in accordance with Appendix C, Aluminum Honeycomb Crush Strength Certification.

NOTE: Each tested honeycomb barrier face shall be retained by the Contractor for a MINIMUM of 30 days prior to disposal.

6.9 STATIC ROLLOVER DEVICE

The static rollover device must be capable of rotating the impacted test vehicle about its longitudinal axis with the axis kept horizontal, to each successive increment of 90° , 180° , and 270° at a uniform rate with 90° of rotation taking place in 1 to 3 minutes.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

7.1 TEST VEHICLES:

The Contractor has the responsibility of accepting test vehicles from either new car dealers or vehicle transporters. In both instances, the Contractor acts in the OVSC's behalf when signing an acceptance of test vehicles. If a vehicle is delivered by a dealer, the Contractor must check to verify the following:

- A. All options listed on the 'window sticker' are present on the test vehicle.
- B. Tires and wheel rims are the same as listed.
- C. There are no dents or other interior or exterior flaws.
- D. The vehicle has been properly prepared and is in running condition.
- E. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
- F. Proper fuel filler cap is supplied on the test vehicle.
- G. Spare tire, jack, lug wrench and tool kit (if applicable) is located in the vehicle cargo area.

The Contractor shall check for damage that may have occurred during transit. The COTR is to be notified of any damage prior to preparation of the vehicle for testing.

A 'Vehicle Condition Report' form (refer to section 15) will be supplied to the contractor by the COTR when the test vehicle is transferred from the new car dealer or between test contracts. The upper half of the form describes the vehicle in detail, and the lower half provides space for a detailed description of the post test condition. Vehicle Condition Report forms must be returned to the COTR with the copies of the Final Test Report or the reports will NOT be accepted.

7.2 SIDE IMPACT DUMMIES (SIDs):

An adequate number of NON-INSTRUMENTED Part 572 Subpart F side impact test dummies (SIDs) will be furnished to the contract laboratory by the OVSC. The dummies shall be stored in an upright-seated position with the weight supported by the internal structure of the pelvis. The dummy's head shall be held upright without supporting the weight of the dummy by using an eye-bolt that can be secured in the top of the head. These dummies shall be stored in a secured room that is kept between 12.8EC and 29.4EC. The Contractor will check the dummy components for damage when performing the calibrations. The COTR will be kept informed of the dummies condition in order that replacement parts can be provided. The Contractor shall keep a detailed record for each SID, describing parts replaced and the results of calibration tests.

8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS

8.1 GENERAL REQUIREMENTS:

Before the Contractor initiates the OVSC test program, a test instrumentation calibration system will be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in MIL-C-45662A, "Calibration System Requirements". The calibration system shall be set up and maintained as follows:

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals not to exceed TWELVE (12) MONTHS for the calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

Before the Contractor initiates the vehicle safety compliance test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration practices. The calibration system shall include the following as a minimum:

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the Contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding **6 months for instruments and 12 months for the calibration standards**. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

Accelerometers shall be calibrated every twelve months or after a vehicle fails to meet the FMVSS 214 performance requirements or after any indication from calibration checks that there may be a problem with the accelerometer whichever occurs sooner.

- C. All measuring and test equipment and measuring standards will be labeled with the following information:
 - (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment

8. CALIBRATION AND TEST INSTRUMENTATION...Continued

- D. A written calibration procedure shall be provided by the Contractor, which includes as a minimum the following information for all measurement and test equipment:
- (1) Type of equipment, manufacturer, model number, etc.
 - (2) Measurement range
 - (3) Accuracy
 - (4) Calibration interval
 - (5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
 - (6) The actual procedures and forms used to perform the calibrations.
- E. Records of calibration for all test instrumentation shall be kept by the Contractor in a manner that assures the maintenance of established calibration schedules.
- F. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the acceptance of the COTR before vehicle safety compliance testing commences.
- G. Test equipment shall receive a system functional check out using a known test input immediately before and after the test. This check shall be recorded by the test technician(s) and submitted with the final report.
- H. The Contractor may be directed by NHTSA to evaluate its data acquisition system. If so directed, the Contractor shall follow the procedures outlined in Appendix E.

Further guidance is provided in the International Standard ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment" and American National Standard ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment General Requirements."

8. CALIBRATION AND TEST INSTRUMENTATION...Continued

8.2 SIDE IMPACT DUMMY (SID) INSTRUMENTATION:

The SID is designed for lateral impacts. The basic design is derived from the Part 572 B dummy with a redesigned chest assembly and without arms. The chest assembly consists of 5 ribs with ballast plates to compensate for the arm weight. A hydraulic piston (damper) is laterally oriented between the ribs and spine on the struck side. The SID is generally configured for left side impact. For a right side impact, the damper must be rotated 180 degrees from the configured orientation. The test vehicle may be impacted on either side. The COTR will decide whether the test should be conducted on the left or right side.

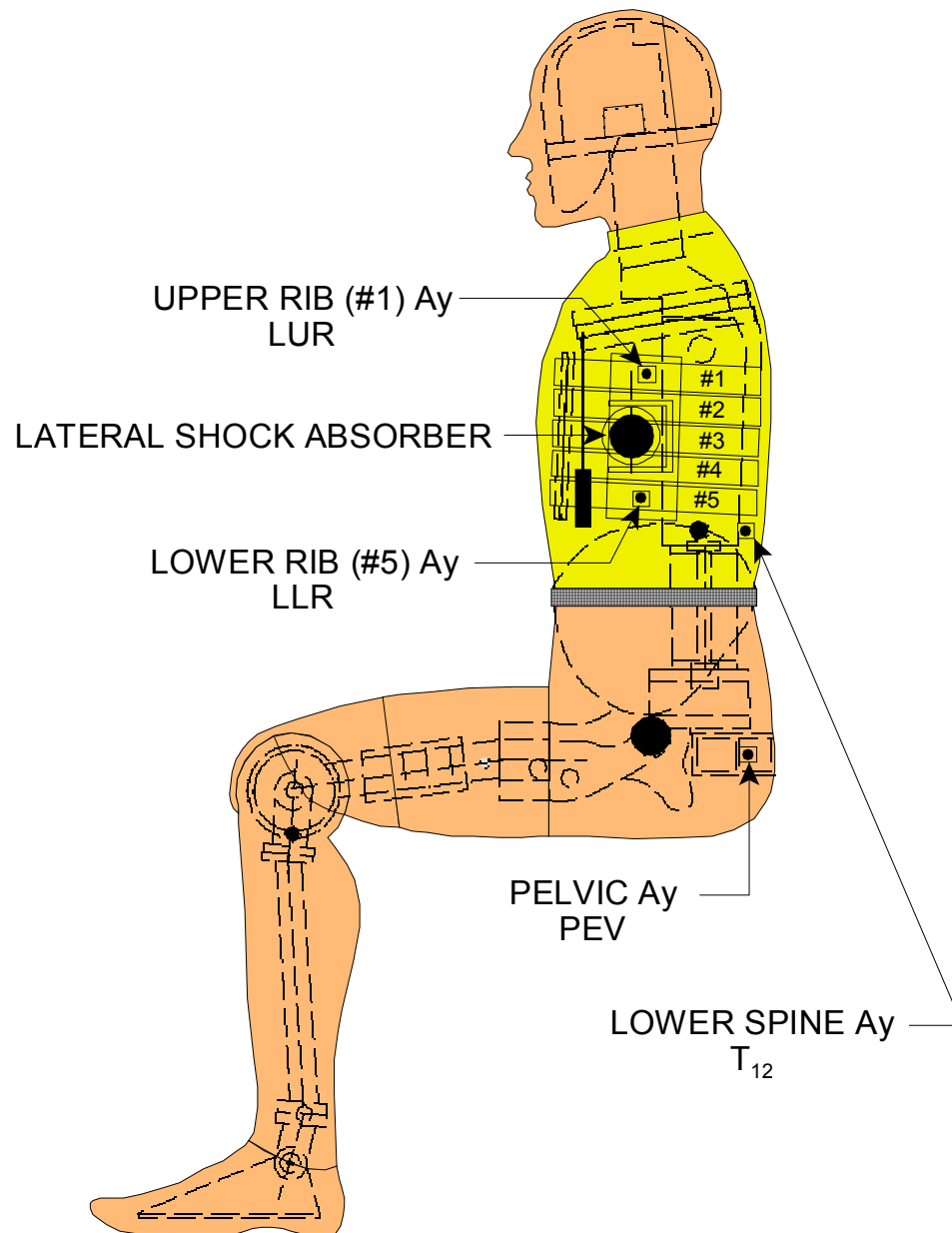
The SID will be instrumented with ENDEVCO MODEL 7264-2000g uniaxial accelerometers configured for Y axis sensitivity (see Figures 2 through 4 on following pages). Redundant accelerometers may be required. Their locations are clearly indicated in the SID Users Manual. For a left-side impact, instrument the dummy as follows;

- A. Left Upper Rib (LUR)
- B. Left Lower Rib (LLR)
- C. Lower Spine (T_{12})
- D. Pelvis Assembly (PEV)

The LARGER VALUE of the two rib accelerations will be combined with the acceleration value of the lower spine to determine the Thoracic Trauma Index (dummy) or TTI(d).

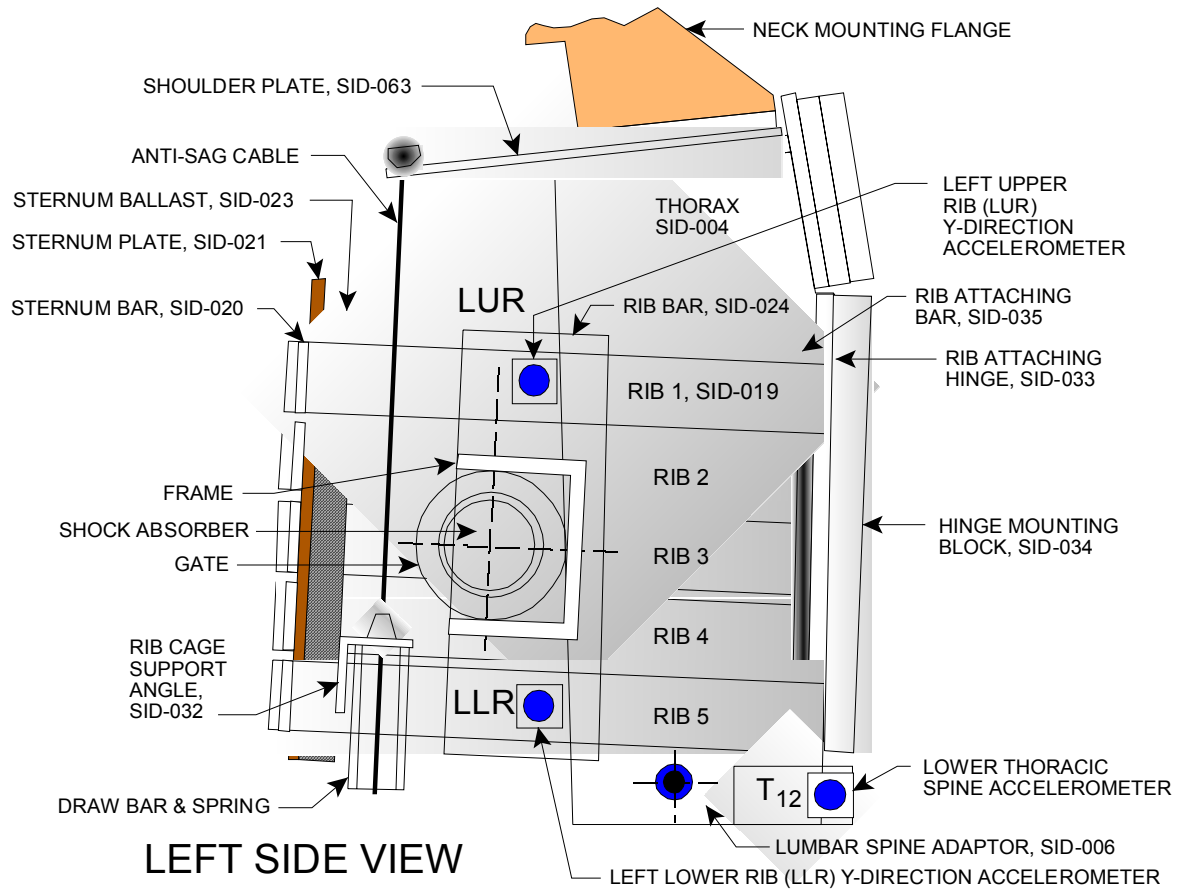
8. CALIBRATION AND TEST INSTRUMENTATION...Continued

Figure 2 – SID Left Side View – Sitting Position



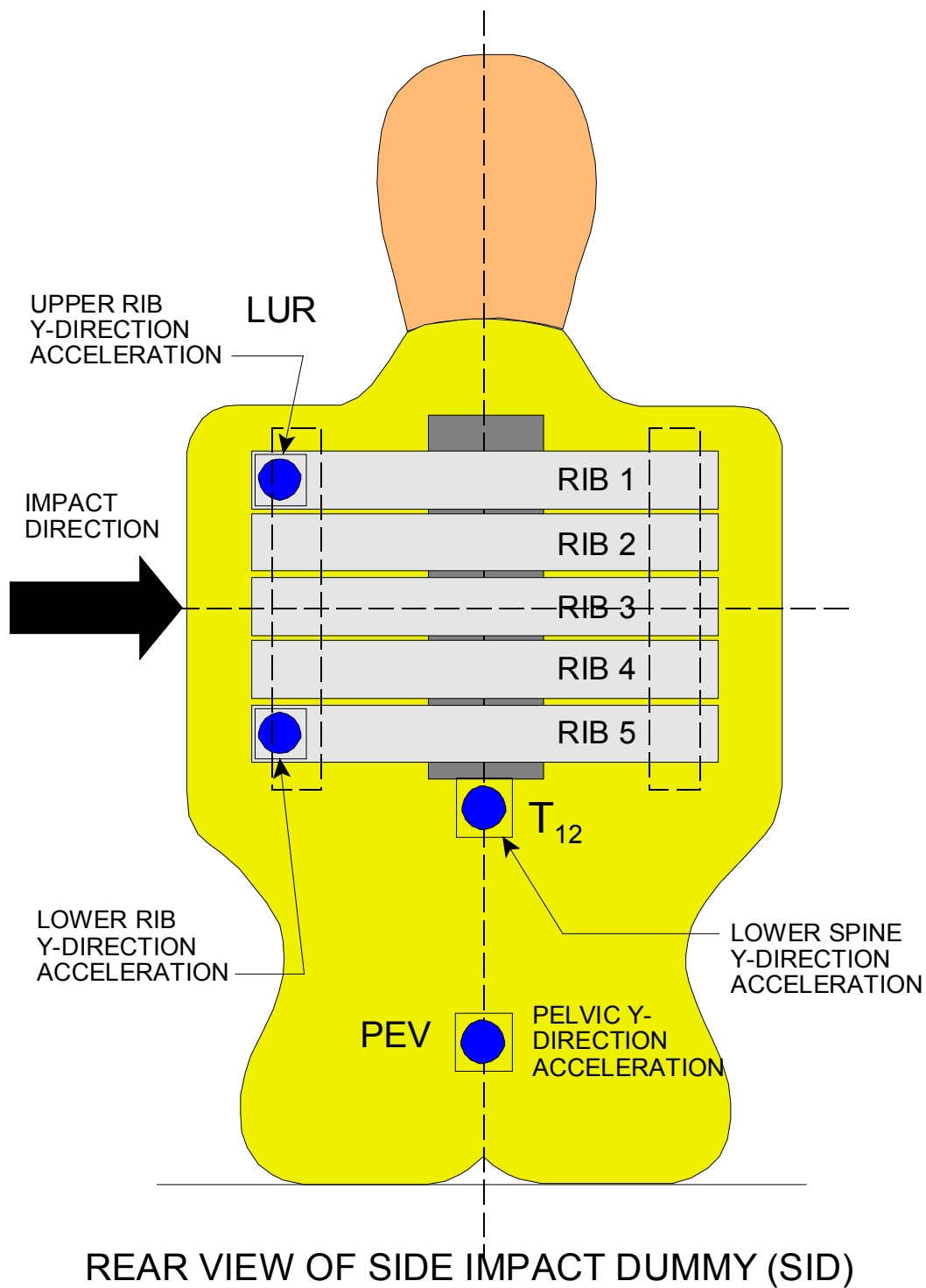
8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

Figure 3 – SID Rib and Chest Assembly



8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

Figure 4 – SID Rear View



8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

8.3 SIDE IMPACT DUMMY (SID) CALIBRATION:

Dummy Configuration and Performance Verification Testing

All GFP Part 572 F test dummies shall be calibrated (pretest and post test) by the contractor ON-SITE using the procedures found in APPENDIX A of this laboratory test procedure.

Post test calibrations must be performed within two weeks after the test. All calibration data shall be recorded on the data sheets as outlined in the Reports Section of this test procedure and submitted with the draft test report for COTR review.

The SIDs shall be clothed with form fitting cotton mid-calf length pants and short sleeve shirts during the calibration test and also during the compliance test.

NOTE: The SID shock absorber shall be calibrated prior to initiating the test program. It is not necessary to calibrate the shock absorber after every impact, but it shall be calibrated after 5 exposures or in the event there is a problem with obtaining acceptable calibration data for the upper or lower ribs.

8.4 DRAWING LIST FOR SIDE IMPACT DUMMY (SID):

In addition to the Part 572B drawings, OVSC COTR will provide the contractor, upon request, any or all of the following SID drawings.

- SID-002 – Lumbar (Molded)
- SID-003 – Lumbar Flange
- SID-004 – Thoracic Assembly
- SID-005 – Thorax to Lumbar Adaptor Assembly
- SID-006 – Lumbar Adaptor
- SID-007 – Thorax Assembly Bottom Plate
- SID-008 – Thorax Assembly Bottom Plate Locator
- SID-009 – Lower Thoracic Spine Accelerometer (T_{12}) Mounting Platform
- SID-010 – Thorax Assembly Side Plate
- SID-011 – Thorax Assembly Front Block
- SID-012 – Thorax Assembly Back Block
- SID-013 – Thorax Assembly Top Plate
- SID-014 – Upper Thoracic Spine Accelerometer (T_1) Base Plate

8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

SID-015 – Front Partition Plate – DELETED
SID-016 – Rear Partition Plate – DELETED
SID-017 – Side Plate Tapping Block – DELETED
SID-018 – Side Impact Rib Assembly
SID-019 – Side Impact Rib (Steel Portion)
SID-020 – Sternum Center Bar
SID-021 – Sternum Plate (Urethane)
SID-022 – Top and Bottom Sternum Bar
SID-023 – Sternum Ballast
SID-024 – Rib Bar
SID-025 – Front Rib Ballast
SID-026 – Rear Rib Ballast
SID-027 – Rib Bar Right Side Ballast
SID-028 – Rib Bar Left Side Ballast
SID-029 – Rib Ballast Cushion
SID-030 – Rib Reinforcement
SID-031 – Sternum Ballast Upper and Lower Washer Bar
SID-032 – Rib Cage Support Angle
SID-033 – Rib Attaching Hinge
SID-034 – Hinge Mounting Block
SID-035 – Rib Cage to Hinge Bar
SID-036 – Upper Thoracic Spine Accelerometer (T_1) Plate
SID-037 – Upper Thoracic Spine Accelerometer (T_1) Mount
SID-038 – Lower Thoracic Spine Accelerometer (T_{12}^{12}) Mount
SID-039 – Lower Thoracic Spine Accelerometer (T_{12}) Cover
SID-040 – Rib Wrap Assembly
SID-041 – Outer Rib Pad
SID-042 – Inner Rib Pad
SID-043 – Rib Bar Washer Strip
SID-046 – Anti-bottoming Pad Spacer -- DELETED
SID-047 – Rib Routing Tube -- DELETED
SID-048 – Upper Thoracic Spine Accelerometer (T_1) Routing Tube – DELETED
SID-049 – Lower Thoracic Spine Accelerometer (T_{12}) Routing Tube – DELETED
SID-050 – Middle Shoulder Foam
SID-051 – Upper Shoulder Foam
SID-052 – Lower Shoulder Foam
SID-053 – Rib Cage General Layout
SID-054 – Shock Absorber (Damper) Gate

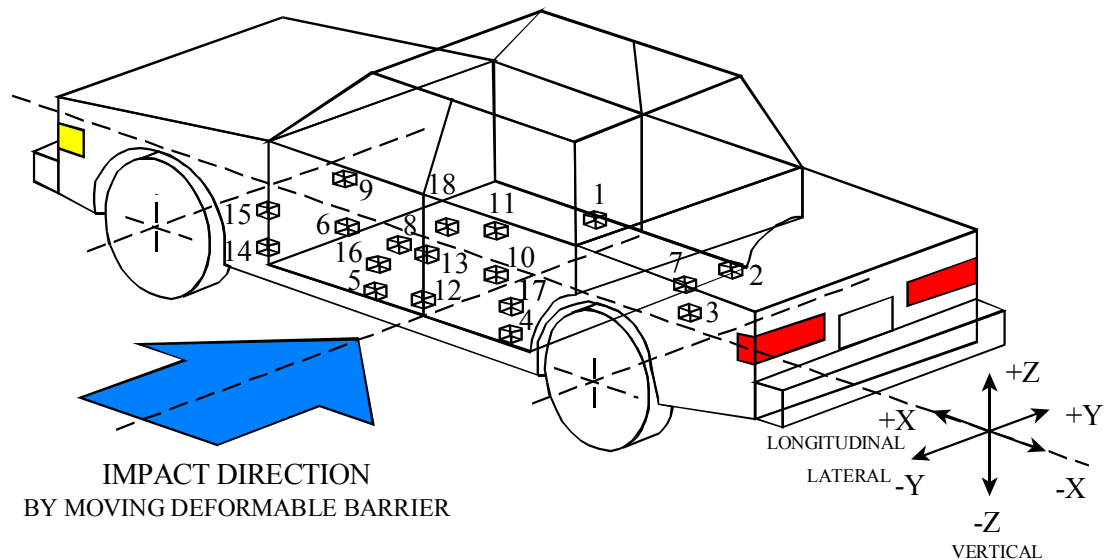
8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

SID-055 – Shock Absorber (Damper) Pivot Pin
SID-056 – Shock Absorber Mounting Frame
SID-057 – Shock Absorber Support Angle
SID-058 – Shock absorber Mount Nylon Washers
SID-059 – Potentiometer Mounting Bracket and Ring – OPTIONAL
SID-060 – Shock Absorber Cap and Rod End – DELETED
SID-061 – Shock Absorber to Rib Bar Attaching Shaft and Spacer
SID-062 – Shock Absorber to Rib Bar Attaching Clevis
SID-063 – Shoulder Plate
SID-064 – Rib Cage Support Details
SID-065 – Outer Skin Zipper Assembly
SID-066 – Outer Skin
SID-067 – Front Zipper Assembly
SID-068 – Rear Zipper Assembly
SID-069 – Arm Foam
SID-070 – Tapered Socket Head Bolt Listing
SID-071 – Socket Head Bolt Listing
SID-072 – Flat Head Socket Bolt Listing
SID-073 – Machine Screw Listing
SID-074 – Hex Nut Listing
SID-075 – Washer Listing
SID-076 – Lower Rib Bar Accelerometer Mount – DELETED
SID-077 – Shock Absorber Rod End
SID-078 – Upper Knee Post
SID-079 – Lower Knee Post
SID-081 – DELETED
SID-082 – DELETED
SID-083 – Thoracic Shock Absorber Test Procedure and Specifications
SID-084 – Rib Ballast Nut Plate
SID-085 – Rib Bar Cushion
SID-086 – DELETED
SID-087 – Pelvis Structure and Flesh Assembly (2 Pages)
SID-088 – Lumbar Pelvic Adaptor
SID-089 – Linear Potentiometer – OPTIONAL
SID-090 – SID Pelvic Accelerometer-- Mount

8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

8.5 TEST VEHICLE INSTRUMENTATION

Figure 5 – Vehicle Accelerometer Locations



The following accelerometers shall be attached to the test vehicle (see Figure 5)

- #1 Triaxial accelerometer mounted on the opposite side to the impacted side sill at the front seat to provide A_x , A_y and A_z data.
- #2 Triaxial accelerometer mounted on the opposite side to the impacted side sill at the rear seat to provide A_x , A_y and A_z data.
- #3 Triaxial accelerometer mounted on the rear floorpan above the axle to provide A_x , A_y and A_z data.
- #4 Uniaxial accelerometer mounted on the impacted side sill in line longitudinally with the center of the widest portion of the rear door and located under the sill inward of pinch welds to provide A_y data.

8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

- #5 Uniaxial accelerometer mounted on the impacted side sill in line longitudinally with the center of the widest portion of the front door and located under the sill inward of pinch welds to provide Ay data.
- #6* Uniaxial accelerometer mounted on the impacted front door on the centerline and approximately 430 mm above the ground to provide Ay data.
- #7 Uniaxial accelerometer mounted in the rear occupant compartment to provide Ay data.
- #8* Uniaxial accelerometer mounted mid-rear of the impacted front door and 430 mm above the ground to provide Ay data.
- #9* Uniaxial accelerometer mounted on the impacted front door upper centerline and approximately 685 mm above the ground to provide Ay data.
- #10* Uniaxial accelerometer mounted mid-rear of the impacted rear door and approximately 685 mm above the ground to provide Ay data.
- #11* Uniaxial accelerometer mounted on the impacted rear door upper centerline approximately 685 mm above the ground to provide Ay data.
- #12 Uniaxial accelerometer mounted on the impacted lower B-Post (located 1/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.
- #13 Uniaxial accelerometer mounted on the impacted middle B-Post (located 2/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.
- #14 Uniaxial accelerometer mounted on the impacted lower A-Post (located 1/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.
- #15 Uniaxial accelerometer mounted on the impacted middle A-Post (located 2/3 the distance from the floor to the bottom of the doors window opening) to provide Ay data.
- #16 Uniaxial accelerometer mounted on the front seat track nearest the impacted door and approximately aligned with the dummy's H-point to provide Ay data.

8. INSTRUMENTATION AND CALIBRATION REQUIREMENTS....Continued

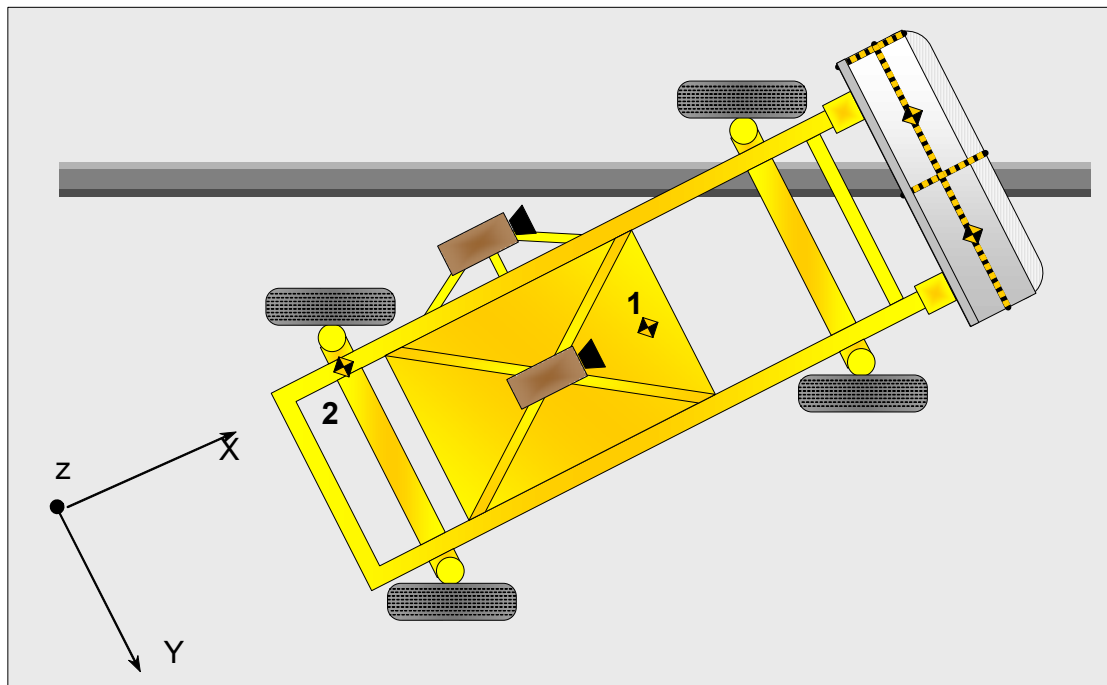
- #17 Uniaxial accelerometer mounted on the rear seat structure (if easily accessible) nearest the impacted door and approximately aligned with the dummy's H-Point to provide A_y data.
- #18 Triaxial Accelerometer mounted on the floor at the vehicle CG to collect A_x , A_y , and A_z data.

NOTE: * These accelerometers (6,8,9,10,11) shall not be installed unless specifically requested by COTR.

8.6 MOVING DEFORMABLE BARRIER (MDB) INSTRUMENTATION:

- A. A triaxial accelerometer is mounted at the MDBs center of gravity to provide A_x , A_y and A_z data
- B. A biaxial accelerometer is mounted on the left side of the frame member (for left-side impacts) or the right-side frame member (for right-side impacts) along the rear axle centerline to provide A_x and A_y data

Figure 6 – MDB Accelerometer Location



9. PHOTOGRAPHIC DOCUMENTATION

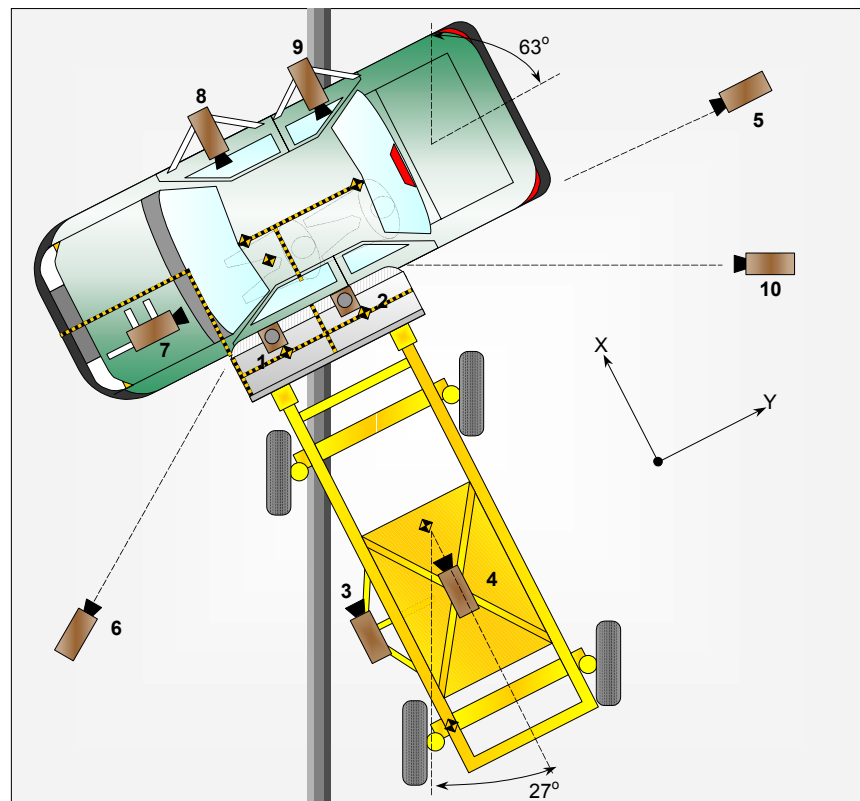
Each side impact test shall be documented in color on video or 16 mm color movie film at a minimum speed of 1000 frames-per-second (fps) except for the 24 fps real-time cameras. High speed film must be taken with negative film from which the positive work film shall be produced.

A timing mark must be registered on the film edge a minimum of every 10 milliseconds (ms) and a time zero impact mark must be registered on the film to indicate when contact is made. High speed video must have a minimum 512 x 512 resolution. A lower resolution must be approved by the COTR.

The impact area must be equipped with sufficient lighting to provide the proper exposure without producing excess glare. The vehicle interior may require auxiliary on-board lighting.

The contractor shall report the locations of all cameras along with camera speeds and lens focal lengths on the appropriate final report data sheet. Camera locations shall be referenced to the target vehicle struck side and the leading edge of the MDB with the X, Y and Z coordinates of the lens recorded for each camera.

Figure 7 – Camera Locations



9. PHOTOGRAPHIC DOCUMENTATION...Continued

9.1 GROUND BASED CAMERAS REQUIRED: (refer to Figure 7)

- A. Camera No. 1 -- high-speed overhead camera to view target vehicle dynamics and positioned directly above the impact plane between the target vehicle and the MDB.
- B. Camera No. 2 -- high-speed overhead camera to provide closeup view of the impact plane (should include view of photo targets on centerline of test vehicle and photo targets on top of MDB barrier face) and positioned adjacent to Camera No. 1.
- C. Camera No. 5 -- high-speed right side view camera to cover both the MDB and the target vehicle during the side impact event.
- D. Camera No. 6 -- high-speed left side view camera to cover the motion of the target vehicle after impact.
- E. Camera No. 10 -- real-time (24 fps) camera to provide pretest, test, and post test coverage.

9.2 MOVING DEFORMABLE BARRIER (MDB) ON-BOARD CAMERAS REQUIRED:

- A. Camera No. 3 -- high-speed camera positioned along the impact face's left vertical edge to cover target vehicle impact point during side impact event.
- B. Camera No. 4 -- high-speed camera positioned on MDB's centerline to view struck side of test vehicle during the side impact event.

9.3 TEST VEHICLE ONBOARD CAMERAS REQUIRED:

- A. Camera No. 7 -- high-speed camera to provide front view of the front SID through the vehicle's windshield from above the engine compartment.
- B. Camera No. 8 -- high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the front dummy during and after side impact.
- C. Camera No. 9 -- high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the rear dummy during and after side impact.

9. PHOTOGRAPHIC DOCUMENTATION

9.4 COLORING REQUIREMENTS FOR PHOTOGRAPHIC PURPOSES:

- A. Vehicle interior surfaces such as the A, B and C-Posts and trim panels, impacted interior door trim panels, etc., shall be painted with flat white paint. The area around the steering hub and instrument panel where air bag deploys, if so equipped, shall NOT be painted. In addition, the air bag indicator light on the dash shall NOT be painted so as to be visible prior to testing.
- B. Body parts of the test dummies shall be coated with colored chalk/water solutions to show contact points with the vehicle's door and interior components. The chalk/water solution shall be applied after final dummy positioning. Horizontal yellow lines will be drawn on the dummies at the lower rib, upper rib and H-point.

CHALK COLORS TO BE USED ON TEST DUMMIES

DUMMY PART	DRIVER	PASSENGER
Face	Blue	Blue
Top of Head	Yellow	Yellow
Back of Head	Red	Red
Left Hip	Red	Red
Left Shoulder	Orange	Orange

9.5 VEHICLE AND DUMMY PHOTOGRAPHIC COVERAGE (REAL-TIME):

The real-time camera (24 fps) shall be used to document the pretest and post test condition of the test vehicle and MDB in addition to the pretest and post test positions of both test dummies including the placement of the lap and shoulder belts on these dummies. Particular attention must be exercised to fully document the proper closing of all vehicle doors, including any rear hatchback and tailgate.

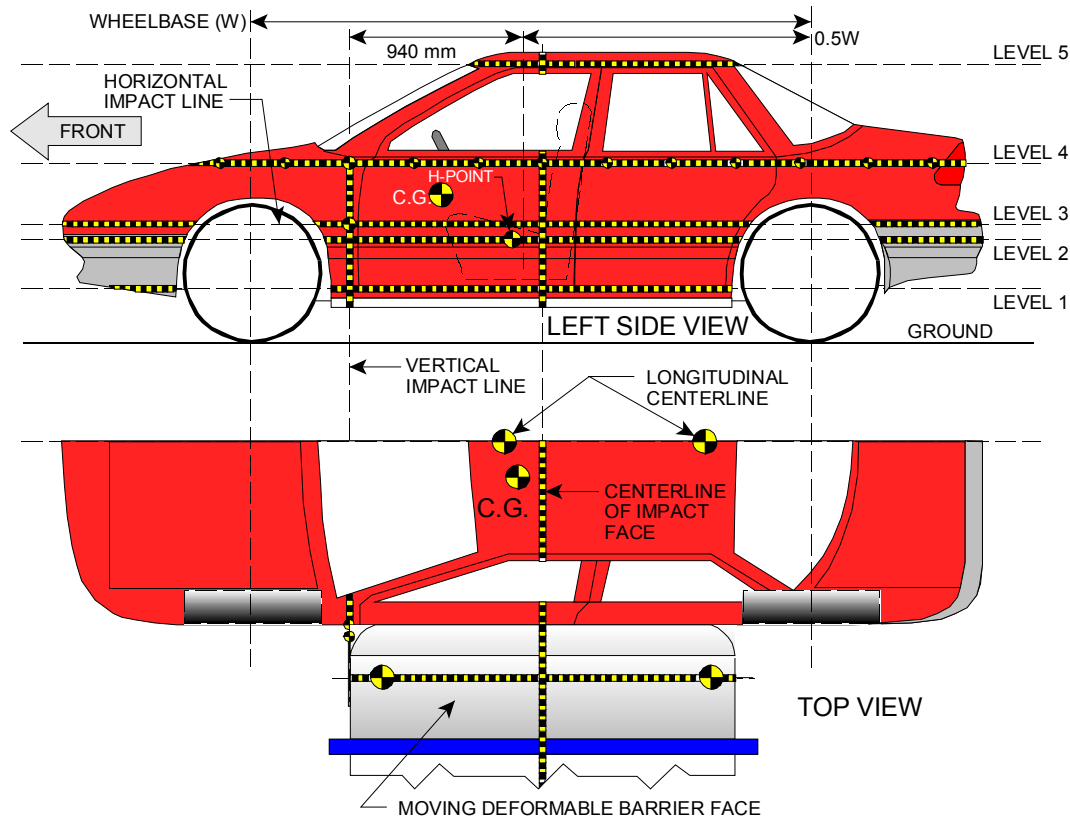
9.6 IMPACT EVENT MARKERS:

It is strongly recommended that in-camera light emitting diodes (LEDs) be used to record the side impact event time zero point. If this is not possible, strobe lights or taped flash bulbs shall be placed in the field-of-view of all nine high-speed cameras to mark the time zero point. The contractor shall use pressure switches attached to the test vehicle or MDB's impact face in order to trigger the time zero indicators.

9. PHOTOGRAPHIC DOCUMENTATION....Continued

9.7 PHOTOGRAPHIC TARGETS AND TAPE FOR MDB AND TEST VEHICLE

Figure 8



- A. Twenty-five millimeter (1") wide checkerboard tape shall be placed along the struck side of the test vehicle at the following five levels above the ground surface --

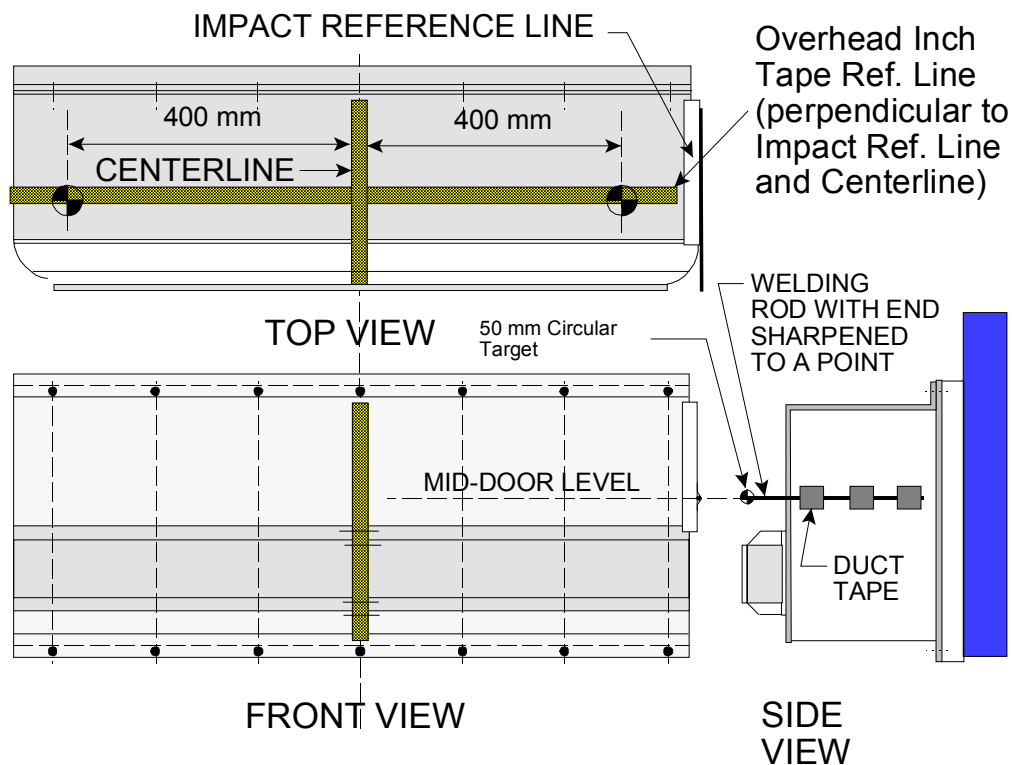
LEVEL 1 -- Top of side sill
 LEVEL 2 -- H-Point
 LEVEL 3 -- Mid-door
 LEVEL 4 -- Window sill
 LEVEL 5 -- Top of window

Also, tape shall be placed along the horizontal and vertical perpendicular impact lines that pass through the impact point as shown in Figure 8. Targets shall be placed on the roof of the test vehicle along the longitudinal centerline and center of gravity. A target shall be placed on the struck side at the center of gravity

9. PHOTOGRAPHIC DOCUMENTATION....Continued

- B. Photographic targets [102 mm diameter (4")] shall be placed on the struck side of the test vehicle every 300 mm along the LEVEL 4 tape line and at the front top left side and rear top left side of the MDB frame.
- C. Other targets shall be placed on the test vehicle as shown in Figure 8.
- D. Tape shall be placed on the barrier face as shown on in Figure 9.
- E. CG marker and other known location markers shall be visible on the MDB in the overhead view.
- F. Photographic targets [102 mm diameter (4")] shall be placed on the MDB at the rear crossmember accelerometer location on the left side of the frame.
- G. Tape on top left surface of honeycomb barrier and tape on top of test vehicle along impact line will be used to document initial impact location.
- H. Two [102 mm (4 ")] diameter targets will be placed on top of barrier face 400 mm from barrier centerline.

Figure 9 – MDB Photographic Tape



9. PHOTOGRAPHIC DOCUMENTATION....Continued

9.8 TARGET VEHICLE INFORMATION PLACARDS:

Test vehicle identification placards shall be positioned so that at least one placard will be visible in each of the 10 camera's field of view. The following information shall be shown:

- A. Target vehicle's NHTSA number
- B. The words "48/24 kph 90^E Side Impact"
- C. Date of the side impact test
- D. Name of contract laboratory
- E. Vehicle year, make and model

9.8 TARGET VEHICLE INFORMATION PLACARDS:

Test vehicle identification placards shall be positioned so that at least one placard will be visible in each of the 10 camera's field of view. The following information shall be shown:

- A. Target vehicle's NHTSA number
- B. The words "48/24 kph 90° Side Impact"
- C. Date of the side impact test
- D. Name of contract laboratory
- E. Vehicle year, make and model

9. PHOTOGRAPHIC DOCUMENTATION....Continued

9.9 CRASH FILM TITLE HEADING & SEQUENCE:

The contractor shall submit 3 copies of the color movie film or high speed video for each crash test two weeks from the date of the vehicle crash test. The master print for each of the crash test films shall be retained by the contractor, but will be made available to the OVSC upon request.

The video or film shall include the following title frames:

- A. The following Side Impact Protection Test was conducted under the contract with the National Highway Traffic Safety Administration by (laboratory name, city, state).
- B. 48/24 kph 90° SIDE IMPACT (MOVING DEFORMABLE BARRIER)
Test Vehicle Model Year, Make and Model
NHTSA No. CXXXXX
Date of Impact Event
Contract No.: DTNH22-9X-X-XXXXX
- C. The ending frame shall state "THE END".

The video or film shall have the following shots and be edited in the following sequence:

TITLE

PRETEST COVERAGE

MDB

- Left side view of MDB
- Right side view of MDB
- Front view of MDB
- Overhead view of MDB

Vehicle

- Impact side view of vehicle
- Rear view of vehicle
- Non-impact side view of vehicle
- Front view of vehicle
- Overhead view of MDB and vehicle orientation

9. PHOTOGRAPHIC DOCUMENTATION....Continued**SID**

- Side View of Sid in front seat (door open)
- Side View of Sid in rear seat (door open)
- Side View of Sid in front seat (door closed)
- Side View of Sid in rear seat (door closed)

View of gas cap being attached to filler pipe

All high speed coverage

- Camera 1 - overhead slow
- Camera 2 - overhead close-up slow
- Camera 5 - rear view
- Camera 6 - front 1/4 view
- Camera 3 - close-up impact point
- Camera 4 - view from MDB
- Camera 7 - view of front dummy thru windshield
- Camera 8 - view front dummy thru side window
- Camera 9 - view rear dummy thru side window
- Camera 10 - real time

POST TEST COVERAGE**MDB**

- View of MDB and vehicle - front of vehicle
- View of MDB and vehicle - rear of vehicle
- View of MDB and vehicle - 1/4 front
- View of MDB and vehicle - 1/4 rear
- View of MDB and vehicle - parallel to impact door

SID

- View of front Sid - parallel to impact door
- View of rear Sid - parallel to impact door
- View of front Sid - thru opposite window
- View of rear Sid - thru opposite window

9. PHOTOGRAPHIC DOCUMENTATION....Continued

Vehicle

- View of impact point - close-up
- View of impacted side (vehicle removed)
- View of front of car
- View of rear of car
- View of inside front door (dummy removed)
- View of inside rear door (dummy removed)
- View of rollover - 90°
- View of rollover - 180°
- View of rollover - 270°
- View of rollover - 360°
- View of failures or any anomalies

“THE END”

NOTE: Filming or video of all doors being closed is taken but **NOT** included in the final submission unless requested by the COTR.

9.10 STILL PHOTOGRAPHS:

Photographs shall be color, 203 mm x 254 mm, and legible. A tag, label or placard identifying the test vehicle model as well as the deformable barrier and NHTSA number, if applicable, shall appear in each photograph and be legible. The test vehicle and deformable barrier shall show the test date. Each photograph shall be labeled as to subject matter. As a minimum the following photographs shall be included:

- A. Pretest and post test frontal views of the target vehicle
- B. Pretest and post test rear views of the target vehicle
- C. Pretest and post test side views of the struck side of the target vehicle showing initial contact point longitudinally and vertically on the target vehicle
- D. Pretest closeup view of welding rod impact point.
- E. Pretest and post test frontal views of the impactor face
- F. Pretest and post test left side views of the impactor face
- G. Pretest and post test right side views of the impactor face

9. PHOTOGRAPHIC DOCUMENTATION....Continued

- H. Pretest and post test top views of the impactor face
- I. Pretest overhead view of the MDB positioned against the side of the target vehicle at the ideal impact point
- J. Pretest and post test occupant compartment views showing the SID positions and the available clearance between the dummy and the struck door, as well as positions of belt restraints (photographs with door closed and with door open)
- K. Pretest left side view of MDB with impact face in position
- L. Pretest right side view of MDB with impact face in position
- M. Post test close-up view of impact point target showing impact location
- N. Pretest view of MDB showing (right and left side) contact switches in place
- O. Pretest and post test views of front inner door panel
- P. Pretest and post test views of rear inner door panel
- Q. Closeup view of vehicle's certification label
- R. Closeup view of vehicle's tire information placard or label
- S. Post test overhead view of the MDB and the target vehicle

Contractors should take photographs of both the left and right side of MDB

10. DEFINITIONS**DESIGNATED SEATING CAPACITY (DSC)**

The number of designated seating positions indicated on the tire information placard required by FMVSS 110. This number must be consistent with the number of restraints in the vehicle.

10. DEFINITIONS....Continued

DESIGNATED SEATING POSITION (DSP)

Any plan view location capable of accommodating a person at least as large as a 5th percentile adult female, if the overall seat configuration and design and vehicle design is such that the position is likely to be used as a seating position while the vehicle is in motion, except for auxiliary seating accommodations such as temporary or folding jump seats. Any bench or split-bench seat in a passenger car, truck or multipurpose passenger vehicle with a GVWR less than 10,000 pounds, having greater than 1270 mm of hip room (measured in accordance with SAE Standard J 1100(a)) shall not have less than three designated seating positions, unless the seat design or vehicle design is such that the center position cannot be used for seating.

H-POINT

The mechanically hinged hip point of a manikin which simulates the actual pivot center of the human torso and thigh, described in SAE Recommended Practice J826, "Manikin for Use in Defining Vehicle Seating Accommodations," May 1987.

LONGITUDINAL OR LONGITUDINALLY

Parallel to the vehicle's longitudinal centerline

OVERALL VEHICLE WIDTH

The nominal design dimension of the widest part of the vehicle, exclusive of signal lamps, marker lamps, outside rearview mirrors, flexible fender extensions, and mud flaps, determined with doors and windows closed and the wheels in the straight-ahead position.

PASSENGER CAR

A motor vehicle with motive power, except a low-speed vehicle, multipurpose passenger vehicle, motorcycle, or trailer, designed for carrying 10 persons or less.

PELVIC IMPACT AREA

Area of the door or body side panel adjacent to any outboard designated seating position which is bounded by horizontal planes 178 mm (7 inches) above and 102 mm (4 inches) below the seating reference point and vertical transverse planes 203 mm (8 inches) forward and 51 mm (2 inches) rearward of the seating reference point.

10. DEFINITIONS....Continued

SEATING REFERENCE POINT

The unique design H-point, as defined in SAE J1100 (June 1984), which:

- (a) Establishes the rearmost normal design driving or riding position of each designated seating position, which includes consideration of all modes of adjustment, horizontal, vertical, and tilt, in a vehicle;
- (b) Has X, Y, and Z coordinates, as defined in SAE J1100 (June 1984), established relative to the designed vehicle structure;
- (c) Simulates the position of the pivot center of the human torso and thigh; and
- (d) Is the reference point employed to position the two-dimensional drafting template with the 95th percentile leg described in SAE J826 (May 1987), or, if the drafting template with the 95th percentile leg cannot be positioned in the seating position, is located with the seat in its most rearward adjustment position.

UNLOADED VEHICLE WEIGHT

The weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but WITHOUT cargo or occupants.

VEHIICLE CAPACITY WEIGHT

The rated cargo and luggage load plus 68 kilograms times the vehicle's designated seating capacity.

VEHICLE FUEL TANK CAPACITY

The tank's unusable capacity (i.e., the volume of fuel left at the bottom of the tank when the vehicle's fuel pump can no longer draw fuel from the tank) plus its usable capacity (i.e., the volume of the fuel that can be pumped into the tank through the filler pipe with the vehicle on a level surface and with the unusable capacity already in the tank). The term does not include the vapor volume of the tank (i.e., the space above the fuel tank filler neck) nor the volume of the fuel tank filler neck.

11. TEST EXECUTION

11.1 TEST VEHICLE PREPARATION:

A. VEHICLE TEST WEIGHT

AS DELIVERED

After the test vehicle is received, fluids will be added to specified levels or filled to capacity and the vehicle weight recorded to determine the "Unloaded Vehicle Weight" (UVW).

NOTE: The scales used to weigh the test vehicle shall be accurate to within 0.1%.

11. TEST EXECUTION....Continued

RATED CARGO AND LUGGAGE WEIGHT

FMVSS 110 requires that the Vehicle Capacity Weight (VCW) and the Designated Seating Capacity (DSC) be recorded on the tire information placard for passenger cars. This information can be used to determine the "Rated Cargo and Luggage Weight" (RCLW) as follows:

$$\text{RCLW} = \text{VCW} - (68 \text{ kg} \times \text{DSC})$$

If this information is not available for MPV's, light trucks or buses use the following calculation:

$$\text{RCLW} = \text{GVWR} - \text{UVW} - (68 \text{ kg} \times \text{DSC})$$

FULLY LOADED (CALCULATED TEST VEHICLE TARGET WEIGHT)

The fully loaded condition is the vehicle loaded to its UVW, plus the vehicles RCLW or 136 kg whichever is less located along the vehicles longitudinal centerline in the luggage compartment, plus the weight of the necessary fully instrumented SID(s) placed in the test configuration.

The calculated Test Vehicle Target Weight (TVTW) [fully loaded test weight] is computed as follows:

$$\text{TVTW} = \text{UVW} + \text{RCLW (or 136 kg whichever is less)} + [(\text{the number of instrumented SIDs}) \times (\text{Dummy weight})]$$

AS TESTED VEHICLE WEIGHT

Drain the fuel system and operate the engine until the fuel system is dry. Slowly refill the entire fuel system (rotate engine) with Stoddard solvent which has been dyed purple, having the physical and chemical properties of Type 1 solvent or cleaning fluid, Table 1, ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents" until, not less than 92 percent and not more than 94 percent, of the vehicle manufacturer's stated "usable capacity" is reached (use the useable capacity supplied by manufacturer, do not use values in the owners manual). This volume will be furnished by the COTR.

11. TEST EXECUTION....Continued

The Stoddard solvent must be filtered while being introduced into the fuel system. Drain all other fluids from the test vehicle with the exception of brake fluid if required for abort system, so that Stoddard solvent leakage from the fuel system will be evident. Just prior to the test, operate the engine to assure that Stoddard solvent is present throughout the entire fuel system.

NOTE: It is permissible to cut small holes in coolant hoses and transmission torque converters to assure that all fluid other than Stoddard solvent has been removed from the vehicle.

Load the vehicle with the required instrumented test dummies and necessary on-board test equipment (including all instrumentation boxes, cameras, lighting, etc.) and then add ballast, if necessary, to achieve the Test Vehicle Target Weight. Weigh the vehicle again and record this weight as the ACTUAL Test Vehicle Weight (TVW).

The ACTUAL Test Vehicle Weight (TVW) shall have the following boundaries;

$(\text{Calculated TVTW} - 4.5 \text{ kg.}) \leq \text{Actual TVW} \leq (\text{Calculated TVTW} + 9 \text{ kg})$

If the Calculated Test Vehicle Target Weight (TVTW) is exceeded, the contractor must notify the COTR to discuss the possible removal of vehicle components or instrumentation to decrease the weight.

NOTE: UNDER NO CIRCUMSTANCES SHALL THE ACTUAL VEHICLE TEST WEIGHT BE GREATER THAN THE TEST VEHICLE TARGET WEIGHT (TVTW).

B. VEHICLE ATTITUDE

If vehicle has an AUTO-LEVELING SYSTEM the ignition must be set to the "on" position when attitude measurements are made. If vehicle has NIVOMAT type system (self adjusting hydraulic system) contact COTR for further guidance on attitude measurements.

11. TEST EXECUTION....Continued

AS DELIVERED

Determine the distance between a level surface, for example a flat roadway, and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" (UVW condition) with all tires inflated to the manufacturer's specifications as listed on the vehicle's tire information label or placard. The vehicle suspension should be exercised prior to making measurements. This entails pushing up and down on all four corners of the vehicle at least 5 times in an interval not to exceed 40 seconds.

FULLY LOADED

Determine the distance (after the vehicle's suspension has been "exercised" and left to settle for at least 10 minutes) between the same level surface or reference plane and the same standard reference points in the vehicle's "fully loaded condition." The "fully loaded condition" is the test vehicle at the target test weight which is (UVW + RCLW + required number of SIDs). The SID(s) are placed in the test configuration and are fully instrumented with shoes and clothing. The load placed in the cargo area shall be centered over the longitudinal centerline of the vehicle.

AS TESTED (PRETEST)

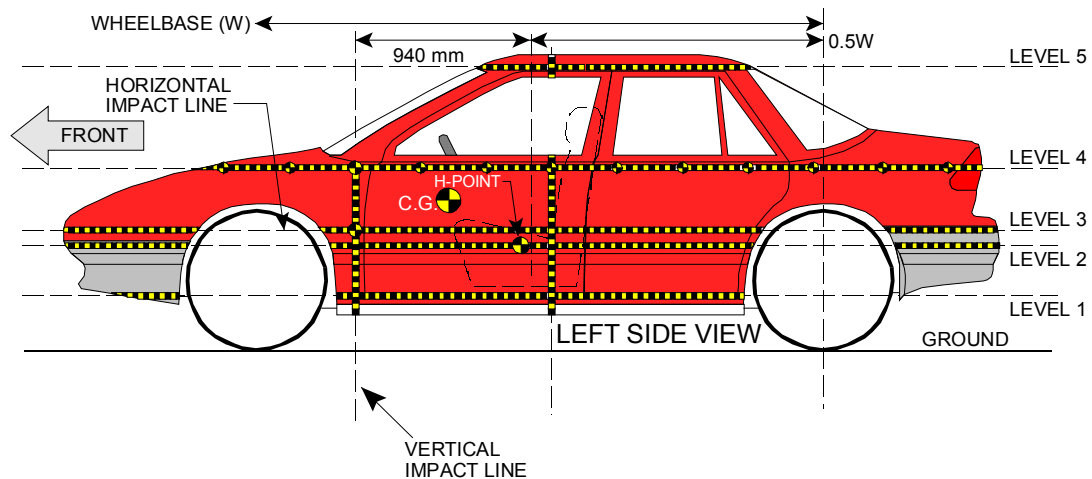
Determine the distance (after the vehicle has been "exercised" and left to settle for at least 10 minutes) between the same level surface or reference plane and the same standard reference points in the vehicle's "as tested condition." The "as tested condition" is the test vehicle at the target test weight which is (UVW + required number of SIDs+ instrumentation & necessary test equipment + ballast (if necessary)). The pretest vehicle attitude shall be equal to either the as delivered or fully loaded attitude or between the as delivered attitude and the fully loaded attitude. If correct attitude can not be attained, COTR shall be notified to determine whether to proceed with test.

NOTE: If vehicle is raised off the ground to make weight measurements, the vehicle should be rolled for at least 10 meters and left to settle for 10 minutes before the "as delivered" or "fully loaded" attitude measurements are made.

11. TEST EXECUTION....Continued

C. IMPACT REFERENCE LINES

Figure 10 – Impact Reference Lines



IMPACT REFERENCE LINE: FOR PASSENGER CARS

As shown in Figure 10 the impact reference line is 940 mm, ± 50 mm, forward of the center of the test vehicle's wheelbase when the test vehicle's wheelbase is less than or equal to 2,896 mm. If the wheelbase is greater than 2,896 mm, then the impact reference line is 508 mm rearward of the test vehicle's front axle centerline.

IMPACT REFERENCE LINE: FOR MPV'S, TRUCKS AND BUSES.

For vehicles with a wheelbase of 2,489 mm or less, the impact reference line is 305 mm rearward of centerline of vehicles front axle, except as otherwise specified in paragraph D of this section.

For vehicles with a wheelbase of greater than 2,489 mm but not greater than 2,896 mm, 940 mm forward of the center of the vehicle's wheelbase, except as otherwise specified below.

11. TEST EXECUTION....Continued

For vehicles with a wheelbase greater than 2,896 mm, the impact reference line is 508 mm rearward of centerline of front wheel axle, except as otherwise specified below.

At the manufacturer's option, for different wheelbase versions of the same model vehicle, the impact reference line may be located by the following.

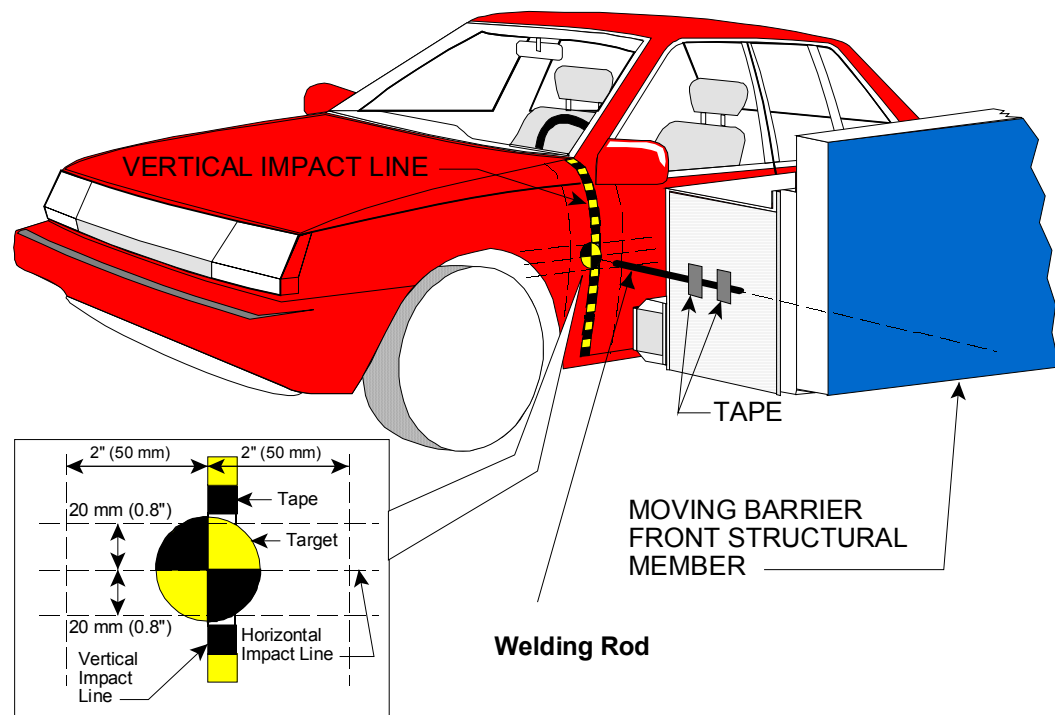
- (a) Select the shortest wheelbase vehicle of the different wheelbase versions of the same model and locate on it the impact reference line at the location described in A , B or C of this section, as appropriate;
- (b) Measure the distance between the seating reference point (SgRP) and the impact reference line;
- (c) Maintain the same distance between the SgRP and the impact reference line for the version being tested as that between the SgRP and the impact reference line for the shortest wheelbase version of the model
- (d) The impact reference line will be located using the procedure used by the manufacturer as the basis for its certification of compliance with the requirements of this standard. If the manufacturer did not use any of the procedures in this section, or does not specify a procedure when asked by the agency, the agency may locate the impact reference line using either procedure.

11. TEST EXECUTION....Continued

D. HONEYCOMB FACE WELDING ROD ALIGNMENT:

A welding rod sharpened to a point on one end will be attached along the left side vertical surface of the honeycomb barrier in the horizontal plane level with the mid-door of the test vehicle as shown in Figure 11. The sharpened tip of the welding rod shall be positioned so as to contact the test vehicle body sheet metal during pretest setup when the MDB is positioned against the side of the test vehicle. A 50 mm diameter photo target shall be positioned on the vehicle so that the tip of the welding rod is located in the center of the target. The welding rod shall be attached to the left side vertical surface of the honeycomb barrier with tape. During the impact event, the point of the welding rod will provide a permanent indentation on the test vehicle impact line. The initial contact between the tip of the welding rod and test vehicle shall be recorded by Camera No. 3.

Figure 11 Welding Rod Alignment



11. TEST EXECUTION....Continued

D. EXTERIOR CRUSH PROFILE MEASUREMENTS

Exterior crush profile measurements shall be made post test. These static crush measurements are to be taken at the five levels (as designated in section 9.7) across the entire length of the vehicle at 150 mm intervals. Pretest measurements are taken with the test vehicle in the "As Tested" attitude. Post-test measurements are taken after impact with the vehicle's wheels inflated and resting on a flat, level surface. The measurements are recorded on Data Sheet 10, section 14.

NOTE: The post test measurements shall begin at the first 150 mm mark forward of forwardmost point of the induced damage and end at the first (150 mm) mark past the rearwardmost point of the induced damage. Manual measurement systems must use a stationary reference.

- E. All test vehicle doors, including any rear hatchback or tailgate, shall be fully closed and latched but NOT LOCKED. Confirm that dash telltales for doors/tailgates are not lit prior to test. Particular care must be exercised to close doors with 2 stage (primary and secondary) latch mechanisms. Take real-time video of final closure of all doors, tailgates and trunks.
- F. The test vehicle tire pressures shall meet those provided by the vehicle manufacturer on the tire placard or label.
- G. The test vehicle's struck side windows shall remain CLOSED but the opposite side windows shall be open to facilitate photography.
- H. Manual transmissions shall be placed in SECOND gear.
- I. Automatic transmissions shall be placed in NEUTRAL.
- J. Parking brakes shall be ENGAGED.
- K. Adjustable seats (on impact and non-impact side) are placed in the adjustment position midway between the forward most and rearmost positions, and then if separately adjustable in a vertical direction, are adjusted to the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used. (ie; the seat will be moved more rearward.)

11. TEST EXECUTION....Continued

- L. Place all adjustable seat backs in the manufacturer's nominal design riding position in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 25 degrees from the vertical.
- M. Place each adjustable head restraint in its highest adjustment position. Position adjustable lumbar supports so that they are set in their released, i.e., full back position.
- N. Adjustable steering controls are adjusted so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. If there is no detent at this position the steering controls will be adjusted according to the manufacturer's instructions.
- O. Convertibles and open-body type vehicles have the top, if any, in place in the closed passenger compartment configuration.
- P. The test dummies shall be restrained using ALL available belt systems in all seating positions.
- Q. Onboard cameras may be removed (with approval of COTR) if there is a problem attaining the test weight of the vehicle. Instrumentation should be removed first if possible.
- R. If there is a problem attaining the vehicles test weight, the COTR may require the onboard instrumentation to be removed. This will entail the instrumentation to be flexible enough to record data outside of the vehicle via umbilical cables or other equivalent (as approved by the COTR) devices.

11.2 DUMMY PREPARATION, POSITIONING AND PLACEMENT:

The stabilized temperature of the test dummy at the time of the side impact test shall be at any temperature between **18.9 °C** and **25.5 °C**. Each test dummy shall be clothed in form fitting cotton stretch garments with short sleeves and midcalf length pants. Each foot of the dummy shall be equipped with a size 11EEE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S-13192 and weighs 0.48 kg to 0.66kg.

11. TEST EXECUTION....Continued

NOTE: Place test dummies in the test vehicle the morning of test day. Do not place the dummies in the vehicle the day before testing for overnight storage.

Dummy positioning procedures are detailed in APPENDIX B.

The final positions of the front and rear dummies seated in the test vehicle shall be recorded (see Figures 12 & 13) by taking the following measurements (accurate to within ± 3 mm);

NOTE: Only one rear seat dummy is required for vehicles having more than one row of seating behind the driver seat.

SID LONGITUDINAL CLEARANCE DIMENSIONS

- *HH Head to Header - taken from the point where the dummy's nose meets his forehead (between his eyes) to the furthest point forward on the header.
- *HW Head to Windshield - taken from the point where the dummy's nose meets his forehead (between his eyes) to a point on the windshield. Use a level.
- HZ Head to Roof - taken from the point where the dummy's nose meets his forehead (between his eyes) to the point on the roof directly above it. Use a level.
- *CS Steering Wheel to Chest - taken from the center of the steering wheel hub to the dummy's chest. Use a level.
- *CD Chest to Dash - place a tape measure on the tip of the driver dummy's chin and rotate 125 mm of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Then measure from this point to the closest point on the dashboard either between the upper part of the steering wheel between the hub and the rim, or measure to the dashboard placing the tape measure above the rim, whichever is a shorter measurement.
- CB Chest to Back of Seat - place a tape measure on the tip of the passenger dummy's chin and rotate 125 mm of it downward toward the dummy to the point of contact on the transverse center of the passenger dummy's chest. Then measure from this point to the closest point on the seat back directly forward of the rear outboard passenger seating position. Mark point on seat back for later NB measurement.
- NR Nose to Rim - taken from the tip of the driver dummy's nose to the closest point on the top of the steering wheel rim
- NB Nose to Back of Seat - taken from the tip of the passenger dummy's nose to the SAME point on the seat back located in CB measurement

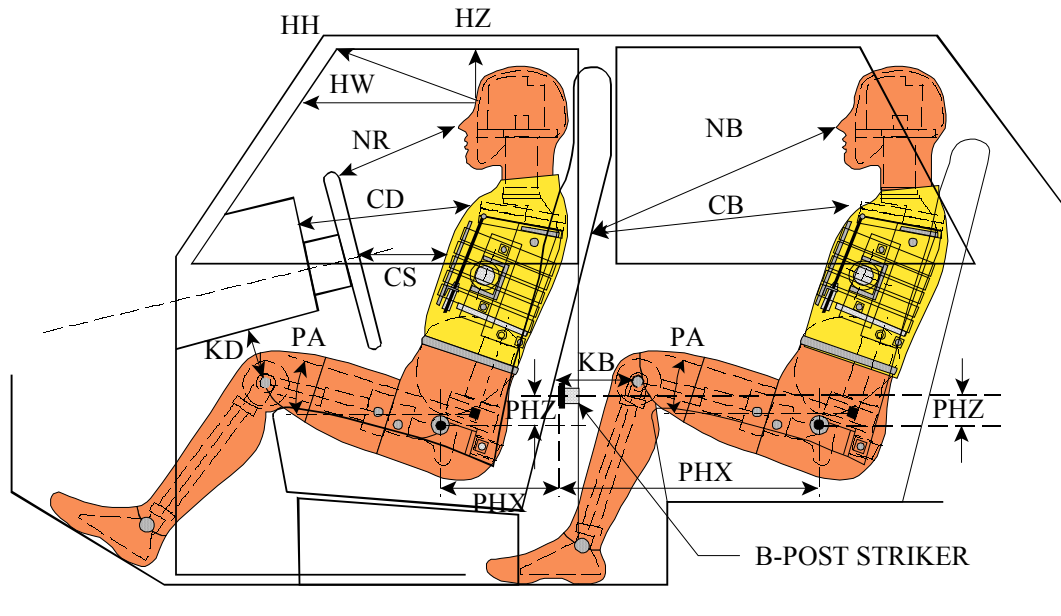
11. TEST EXECUTION....Continued

- KDL Left and Right Knees to Dashboard - taken from the center of the knee pivot.
- KDR Bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard. Also reference the angle of this measurement with respect to the horizontal for the outboard knee (KDA).
- KBL Left and Right Knees to Seat Back - taken from the center of the knee pivot.
- KBR Bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the seat back. Also reference the angle of this measurement with respect to the horizontal for the outboard knee (KBA).
- PHX H-Point to Striker(X) - locate a point on the striker; project this point (preferably, with a level) vertically downward; place tape measure on H-point and extend horizontally until it intersects level; record this measurement.
- PHZ H-Point to Striker(Z) - locate a point on the striker; project this point (preferably, with a level) horizontally toward the H-point; place tape measure on H-point and extend vertically until it intersects level; record this measurement.

NOTE: When testing 2-door vehicles, the B-post striker will be used as the reference point for PHX & PHZ measurements. When testing 4-door vehicles, the B-post striker will serve as the reference point for the front seat occupant, while the C-post striker will be used for the rear seat occupant.

11. TEST EXECUTION....Continued

Figure 12 – SID Longitudinal Measurements



LEFT SIDE VIEW

NOTE: 2-DOOR VEHICLE SHOWN.
REAR DUMMY PHX & PHZ
MEASUREMENTS FOR A 4-DOOR
VEHICLE WOULD USE THE C-POST
STRIKER AS A REFERENCE POINT

NOTE: 2-door vehicle shown in Figure 12. Rear dummy PHX and PHZ measurements for a 4-door vehicle would use the C post striker as a reference point.

SID LATERAL CLEARANCE DIMENSIONS

- *HR Head to Side Header - measure the shortest distance from the point where the dummy's nose meets his forehead (between his eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.
- *HS Head to Side Window - taken from the point where the dummy's nose meets his forehead (between his eyes) to the outside of the side window. In order to make this measurement, roll the window down to the exact height which allows a level measurement. Use a level.

11. TEST EXECUTION....Continued

- *AD Arm to Door - taken from the center of the bottom of the arm segment where it meets the dummy's torso to the closest point on the door.
- *HD H-point to Door - taken from the H-point on the dummy to the closest point on the door. Use a level.

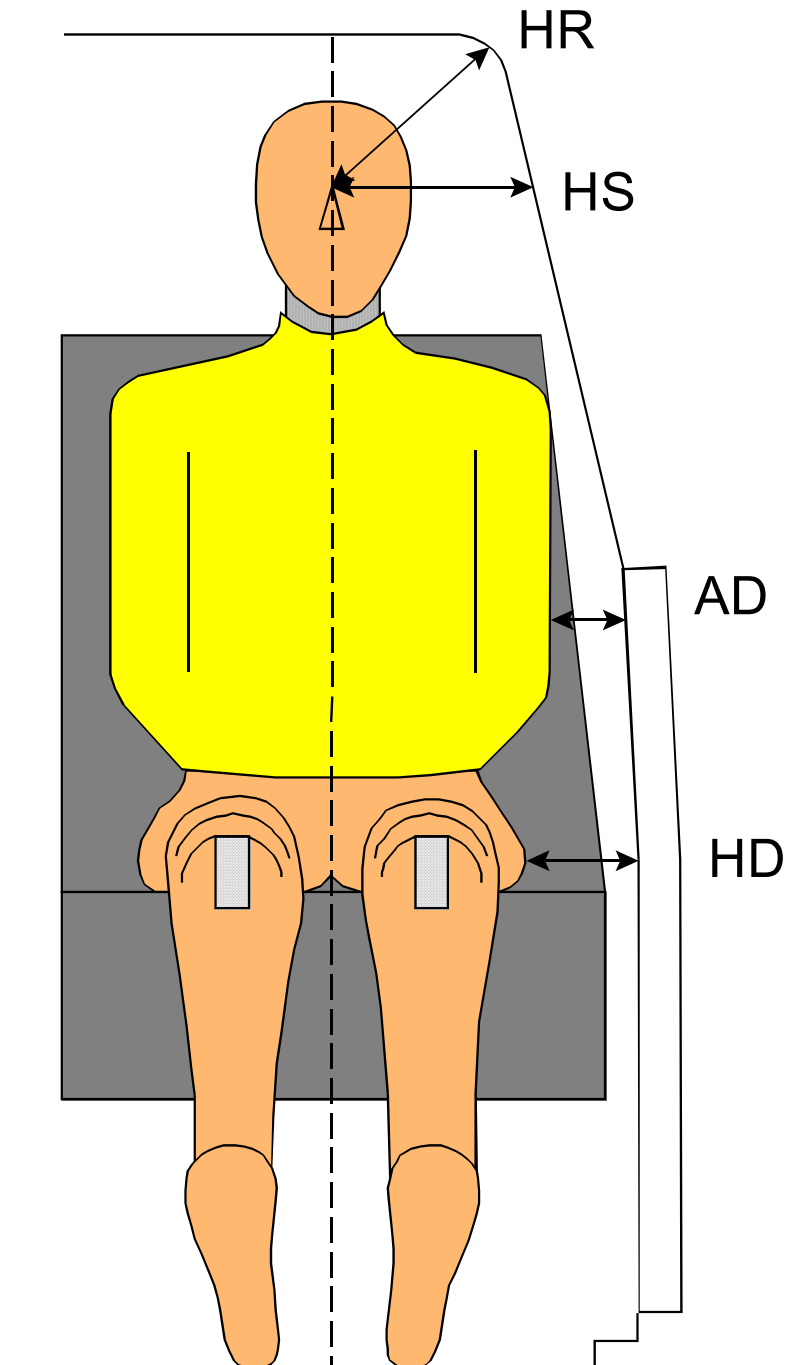
ANGLES

- SA Seat Back Angle - measured using the instructions provided by the manufacturer on Form No. 2 - Manufacturer Supplied Information; If no information is supplied, place adjustable seat backs at the first detent rearward of 25 degrees from the vertical.
- PA Pelvic Angle - taken by inserting the pelvic angle gauge into the H-point gauging hole on the SID and taking this angle with respect to the horizontal;

When a level is to be used, it is to ensure that the line containing the two points described is either parallel or perpendicular to the ground. If a measurement to be made is less than 250 mm ignore the directions to use a level and approximate a level measurement. Also, when a measurement is to be taken to or from the center of a bolt on the dummy, take the measurement from the center of the bolt hole if the bolt is recessed.

* Measurement used in Data Tape Reference Guide

Figure 13 – Sid Lateral Clearance Measurements



11. TEST EXECUTION....Continued

11.3 MOVING DEFORMABLE BARRIER (MDB) IMPACT FACE CRUSH MEASUREMENTS:

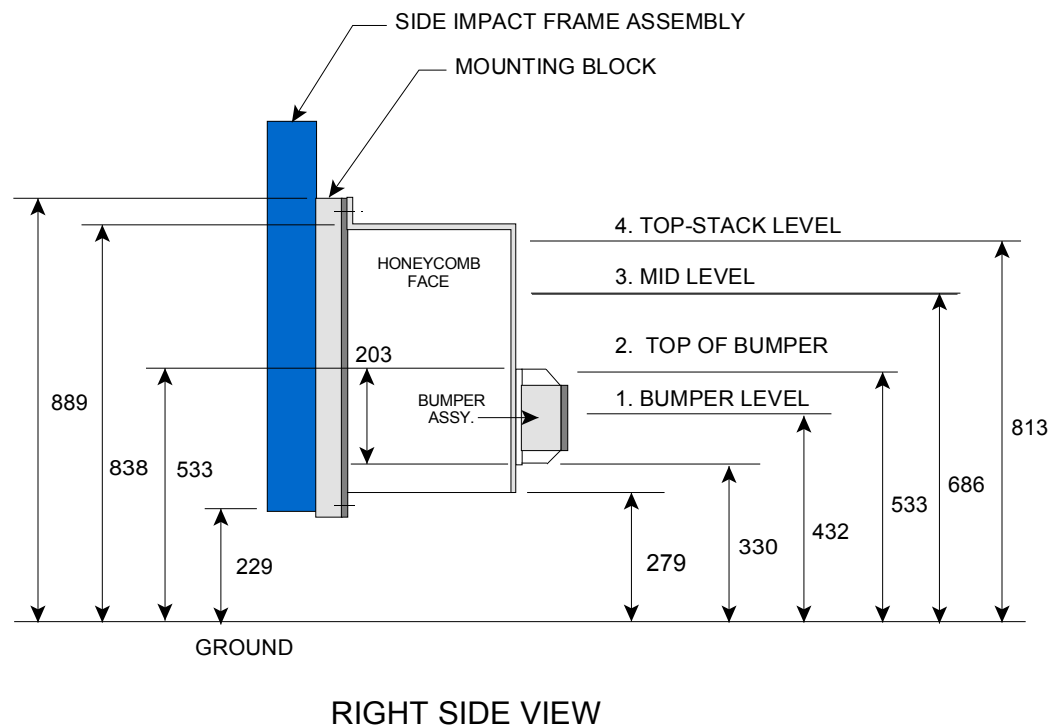
The maximum static crush of the MDB's honeycomb face shall be measured in the longitudinal direction at the following vertical locations (see Figure 15):

- A. Center of Bumper Level = 432 mm above ground level
- B. Top of Bumper Level = 533 mm above ground level
- C. Mid Level = 686 mm above ground level
- D. Top-stack Level = 813 mm above ground level

The crush data shall be recorded on Data Sheet 12, "Exterior Static Crush for Impactor Face" (see Section 14). Pretest and post test measurements are taken (from a reference plane perpendicular to and 1000 mm from the MDB's longitudinal centerline) across the barrier face at 100 mm intervals at each of the four levels specified previously.

NOTE: The MDB crush measurement procedure is similar to the procedure used for vehicle crush measurements.

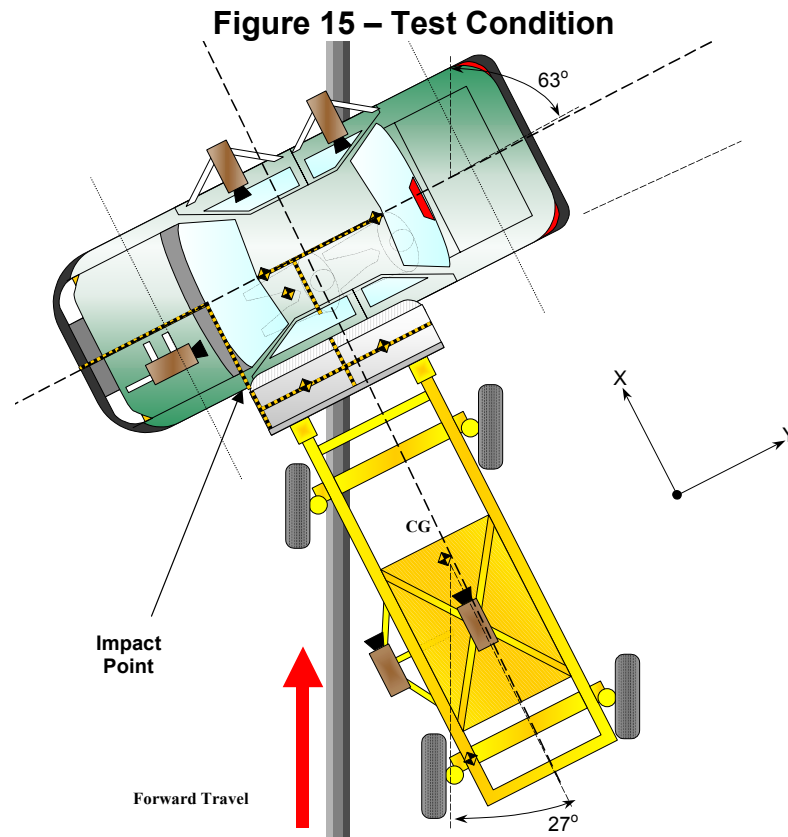
Figure 14 – Honeycomb Face Static Measurements



NOTE: All measurements on this graphic are in millimeters and have a tolerance of 3 mm

11. TEST EXECUTION....Continued

11.4 SIDE IMPACT TEST CONDITION:



- A. Test vehicle is VEHICLE A as shown in Figure 15.
- B. Moving Deformable Barrier (MDB) is VEHICLE B
- C. Line of forward motion of the MDB shall form an angle of $63^{\circ} \pm 0.5^{\circ}$ with the centerline of the test vehicle.
- D. Centerline of the MDB shall be perpendicular $90^{\circ} \pm 1.5^{\circ}$ to the centerline of the test vehicle at the time of impact.
- E. The MDB shall be crabbed at an angle of $27^{\circ} \pm 1^{\circ}$ to the line of forward motion. This crabbed impactor position simulates a moving vehicle to vehicle collision.
- F. Impact speed shall be $52.9 \text{ kph} \pm 0.8 \text{ kph}$ for compliance test purposes.
- G. The MDB shall weigh $1,361 \text{ kg} \pm 4.5 \text{ kg}$ for compliance test purposes.
- H. The longitudinal impact tolerance is $\pm 50 \text{ mm}$ (between MDB and test vehicle).
- I. The vertical impact tolerance is $\pm 20 \text{ mm}$.
- J. The MDB brakes shall be applied 1000 to 1500 milliseconds (1 to 1.5 seconds) after the side impact (duration of MDB/vehicle contact is approximately 150 milliseconds).

11. TEST EXECUTION....Continued

11.5 FUEL SYSTEM INTEGRITY

Fluid Collection after Impact Test

Containers for the collection of possible Stoddard solvent spillage and a stop watch or timing device for documenting the rate of leakage are required to determine compliance with FMVSS No. 301 requirements. Containers must be labeled and photographed.

Immediately after impact, check to see if any Stoddard solvent has spilled from the vehicle. If spillage is apparent, it must be collected immediately. FMVSS No. 301 requires that Stoddard spillage not exceed 142 grams during the first 5-minute interval following impact. For the subsequent 25-minute period, Stoddard spillage during any 1-minute interval must not exceed 28 grams.

Static Rollover Test

The Contractor must conduct a static rollover test within 30 minutes after the vehicle impact unless Stoddard spillage is already apparent. The Contractor must keep the test vehicle under constant observation for Stoddard solvent spillage during the transition between impact and static rollover testing.

The vehicle is placed on a static rollover device and rotated about its longitudinal axis, with the axis kept horizontal, to each successive increment of

- (1) 90°
- (2) 180°
- (3) 270°
- (4) 360°

at a uniform rate, with 90° of rotation taking place in any time interval from 1 to 3 minutes. After reaching each 90° increment the vehicle is held in that position for 5 minutes.

FMVSS No. 301 requires that Stoddard solvent spillage, from the onset of rotational motion, shall not exceed a total of 142 grams for the first 5 minutes of testing at each successive 90° increment. For the remaining testing period, at each increment of 90°, solvent spillage during any 1-minute interval shall not exceed 28 grams.